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ENGINEERING CHANGE NOTICE

Page 1 of 2

1. ECN 653802

Proj. ECN

2. ECN Category (mark one)	3. Originator's Name, Organization, MSIN, and Telephone No.	4. USQ Required?	5. Date
Supplemental [] Direct Revision [X] Change ECN [] Temporary [] Standby [] Supersedure [] Cancel/Void []	Andrew M. Templeton, Data Assessment and Interpretation, R2-12, 373-5589	[] Yes [X] No	05/26/99
	6. Project Title/No./Work Order No.	7. Bldg./Sys./Fac. No.	8. Approval Designator
	Tank 241-T-102	241-T-102	N/A
	9. Document Numbers Changed by this ECN (includes sheet no. and rev.)	10. Related ECN No(s).	11. Related PO No.
	HNF-SD-WM-ER-700, Rev. 0-B	ECNs: 635534, 636888	N/A

12a. Modification Work	12b. Work Package No.	12c. Modification Work Complete	12d. Restored to Original Condition (Temp. or Standby ECN only)
[] Yes (fill out Blk. 12b) [X] No (NA Blks. 12b, 12c, 12d)	N/A	N/A Design Authority/Cog. Engineer Signature & Date	N/A Design Authority/Cog. Engineer Signature & Date

13a. Description of Change 13b. Design Baseline Document? [] Yes [X] No

This ECN has been generated in order to update the document to reflect results of recent data/information evaluation.

Replace pages:

1-1, 1-2, 2-1, 2-2, 4-1,4-2, 5-1, ~~and~~ 5-2 and B3, B4

14a. Justification (mark one)

Criteria Change	[X]	Design Improvement	[]	Environmental	[]	Facility Deactivation	[]
As-Found	[]	Facilitate Const	[]	Const. Error/Omission	[]	Design Error/Omission	[]

14b. Justification Details

A tank characterization report page change revision is required to reflect the results of recent evaluation of data/information pertaining to adequacy of tank sampling for safety screening purposes (Reynolds et al. 1999, Evaluation of Tank Data for Safety Screening, HNF-4217, Rev. 0, Lockheed Martin Hanford Corporation, Richland, Washington).

15. Distribution (include name, MSIN, and no. of copies)

See attached distribution.

RELEASE STAMP

DATE MAY 27 1999

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1. ECN (use no. from pg. 1) ECN-653802

16. Design Verification Required	17. Cost Impact				18. Schedule Impact (days)	
	ENGINEERING		CONSTRUCTION			
[] Yes	Additional	[] $	Additional	[] $	Improvement	[]
[X] No	Savings	[] $	Savings	[] $	Delay	[]

19. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 13. Enter the affected document number in Block 20.

SDD/DD	[]	Seismic/Stress Analysis	[]	Tank Calibration Manual	[]
Functional Design Criteria	[]	Stress/Design Report	[]	Health Physics Procedure	[]
Operating Specification	[]	Interface Control Drawing	[]	Spares Multiple Unit Listing	[]
Criticality Specification	[]	Calibration Procedure	[]	Test Procedures/Specification	[]
Conceptual Design Report	[]	Installation Procedure	[]	Component Index	[]
Equipment Spec.	[]	Maintenance Procedure	[]	ASME Coded Item	[]
Const. Spec.	[]	Engineering Procedure	[]	Human Factor Consideration	[]
Procurement Spec.	[]	Operating Instruction	[]	Computer Software	[]
Vendor Information	[]	Operating Procedure	[]	Electric Circuit Schedule	[]
OM Manual	[]	Operational Safety Requirement	[]	ICRS Procedure	[]
FSAR/SAR	[]	IEFD Drawing	[]	Process Control Manual/Plan	[]
Safety Equipment List	[]	Cell Arrangement Drawing	[]	Process Flow Chart	[]
Radiation Work Permit	[]	Essential Material Specification	[]	Purchase Requisition	[]
Environmental Impact Statement	[]	Fac. Proc. Samp. Schedule	[]	Tickler File	[]
Environmental Report	[]	Inspection Plan	[]		[]
Environmental Permit	[]	Inventory Adjustment Request	[]		[]

20. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number Revision
N/A		

21. Approvals

Signature	Date	Signature	Date
Design Authority		Design Agent	
Cog. Eng. A.M. Templeton for John W. Hunt	5/27/99	PE	
Cog. Mgr. K.M. Hall Kathleen M. Hall	5/27/99	QA	
QA		Safety	
Safety		Design	
Environ.		Environ.	
Other		Other	
		DEPARTMENT OF ENERGY	
		Signature or a Control Number that tracks the Approval Signature	
		ADDITIONAL	

Tank Characterization Report for Single-Shell Tank 241-T-102

Andrew M. Templeton
Lockheed Martin Hanford Corp., Richland, WA 99352
U.S. Department of Energy Contract 8023764-9-K001

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RECORD OF REVISION	(1) Document Number HNF-SD-WM-ER-700	Page 1

(2) Title
Tank Characterization Report for Single-Shell Tank 241-T-102

CHANGE CONTROL RECORD

(3) Revision	(4) Description of Change - Replace, Add, and Delete Pages	Authorized for Release	
		(5) Cog. Engr.	(6) Cog. Mgr. Date
0	(7) Initially released 06/24/97 on EDT-617655.	J.H. Baldwin	K.M. Hall
0-A RS	Incorporate per ECN-635534.	J.H. Baldwin J.H. Baldwin	K.M. Hall Kathleen M. Hall 9/26/97
0-B RS	Incorporate per ECN-636888.	M.J. Kupfer M.J. Kupfer 8-27-98	K.M. Hodgson K.M. Hodgson 9-1-98
0-C RS	Incorporate per ECN-653802.	A.M. Templeton A.M. Templeton	K.M. Hall Kathleen M. Hall 5/21/99

1.0 INTRODUCTION

A major function of the Tank Waste Remediation System (TWRS) is to characterize wastes in support of waste management and disposal activities at the Hanford Site. Analytical data from sampling and analysis, along with other available information about a tank, are compiled and maintained in a tank characterization report (TCR). This report and its appendixes serve as the TCR for single-shell tank 241-T-102.

The objectives of this report are: 1) to use characterization data in response to technical issues associated with tank 241-T-102 waste; and 2) to provide a standard characterization of this waste in terms of a best-basis inventory estimate. The response to technical issues is summarized in Section 2.0, and the best-basis inventory estimate is presented in Section 3.0. Recommendations regarding safety status and additional sampling needs are provided in Section 4.0. Supporting data and information are contained in the appendixes. This report supports the requirements of the *Hanford Federal Facility Agreement and Consent Orders* (Ecology et al. 1996) milestone M-44-05.

1.1 SCOPE

Characterization information presented in this report originated from sample analyses and known historical sources. The most recent core sampling of tank 241-T-102 (March 1993) predated the existence of data quality objectives (DQOs). An assessment of the technical issues from the currently applicable DQOs was made using data from the 1993 push mode core sampling event, a July 1994 grab sampling event, and a May 1996 vapor flammability measurement. Historical information for tank 241-T-102, provided in Appendix A, includes surveillance information, records pertaining to waste transfers and tank operations, and expected tank contents derived from a process knowledge model.

Table 1-1 describes the tank 241-T-102 sampling events. Appendix B contains further sampling and analysis data from the March 1993 push mode core sampling event and data from the grab sampling event in August 1994 and May 1996 vapor flammability measurement. Of the two push mode cores taken in March of 1993, cores 55 and 56, only core 55 had sufficient recovery for analysis. The sampling and analysis of the 1994 grab samples were performed in accordance with Schreiber (1994) and the results were originally reported in WHC (1994). Appendix C provides information on the statistical analysis and numerical manipulation of data used in issue resolution. Appendix D contains the evaluation to establish the best basis for the inventory estimate and the statistical analysis performed for this evaluation. Appendix E is the bibliography that resulted from an in-depth literature search of all known information sources applicable to tank 241-T-102 and its respective waste type. The reports listed in Appendix E may be found in the Tank Characterization and Safety Resource Center.

Table 1-1. Summary of Recent Sampling.

Sample/Date	Phase	Location	Segmentation	% Recovery
Vapor flammability[1] (5/09/96)	Gas	Tank headspace,6 m (20 ft) below top of riser	n/a	n/a
Core 55 (3/25/93)	Solid	Riser 2	1 segment	65%
Core 56 (3/28/93)	Solid	Riser 8	1 segment	10%
Grab sample (7/15/94)	Liquid	Riser 2	3 grab bottles	100%

Note:

n/a = not applicable

[1]Wilkins et al. 1996

Dates are provided in mm/dd/yy format.

1.2 TANK BACKGROUND

Tank 241-T-102 was constructed in 1943 and put into service in 1945. It is the second tank in a cascade system with tanks T-101 and T-103. During its process history, tank 241-T-102 received mostly metal waste (MW) from the Bismuth Phosphate Process and coating waste (CW) from the REDOX Process through the cascade from tank 241-T-101 and in transfers from tank 241-C-102. In 1956, the MW was removed from tank 241-T-102 by pumping and sluicing. This tank was declared inactive and removed from service in 1976. In 1981, intrusion prevention and stabilization measures were taken to isolate the waste in tank 241-T-102.

A description of tank 241-T-102 is summarized in Table 1-2. The tank has an operating capacity of 2,010 kL (530 kgal), and presently contains an estimated 121 kL (32 kgal) of non-complexed waste (Hanlon 1997). The tank is not on the Watch List (Public Law 101-510).

2.0 RESPONSE TO TECHNICAL ISSUES

The following technical issues have been identified for tank 241-T-102.

Safety screening:

- Does the waste pose or contribute to any recognized potential safety problems?

Hazardous vapor safety screening:

- Does a potential exist for worker hazards associated with the toxicity of constituents in tank fugitive vapor emissions?

Organic Solvents:

- Does an organic solvent pool exist that may cause an organic solvent pool fire or ignition of organic solvents entrained in waste solids?

Sections 2.1, 2.2 and 2.3 address the above issues. The organic solvents issue cannot be addressed at this time because vapor sampling beyond flammability screening has not been conducted. The worker toxicity issue has been resolved (Hewitt 1996).

Section 2.4 addresses other technical issues (heat generation in the waste).

2.1 SAFETY SCREENING

The requirements needed to screen the waste in tank 241-T-102 for potential safety problems are documented in *Tank Safety Screening Data Quality Objective* (Dukelow et al. 1995). These potential safety problems are exothermic conditions in the waste; flammable gases in the waste and/or tank headspace; and criticality conditions in the waste. Each of these conditions is addressed separately below.

Although core sampling of tank 241-T-102 preceded the implementation of the DQO process for addressing tank waste issues, the core sampling and analytical direction was consistent with the guidance of the DQO. The tank was sufficiently sampled to satisfy the requirements of safety screening (Reynolds et al.1999).

2.1.1 Exothermic Conditions (Energetics)

The first requirement outlined in the safety screening DQO (Dukelow et al. 1995) is to determine if fuel is present in tank 241-T-102 that could cause a safety hazard. Because of this requirement, energetics in the tank 241-T-102 waste were evaluated. The safety screening DQO required that the waste sample profile be tested for energetics every (24 cm [9.5 in.]) to

determine if the energetics exceed the safety threshold limit. The threshold limit for energetics is 480 J/g on a dry weight basis. The samples did not exhibit exotherms.

Historically, there is no evidence that any exothermic agent should exist in this waste. Waste transfer records indicate that the major waste type expected to be in the tank is PUREX cladding waste (CWP2) above a shallow layer of metal waste. Neither of these waste types is expected to have organic or ferrocyanide constituents.

The safety screening DQO requires measurements for two core samples, therefore this DSC safety issue has not been resolved with respect to the DQO. A second core is required to resolve this issue.

2.1.2 Flammable Gas

Combustible gas monitoring of the tank headspace on May 9, 1996 (Wilkins et al. 1996) indicated that no flammable gas was detected (zero percent of the lower flammability limit). Appendix B provides data from this vapor phase measurement. These data satisfy the safety screening DQO for addressing tank vapor flammability concerns.

2.1.3 Criticality

The safety threshold limit is 1 g ^{239}Pu per liter of waste. Assuming that all alpha is from ^{239}Pu with a measured density of 1.79 g/mL, 1 g/L of ^{239}Pu is equivalent to 34 μCi/g of alpha activity. According to the safety screening DQO, each sample must be under the limit when compared to a 95 percent upper confidence interval on the mean. The upper limit of the one-sided 95 percent confidence interval for the push mode core sample was 0.24 μCi/g. The method used to calculate confidence limits is contained in Appendix C.

Plutonium-239/240 was measured directly for the grab sample. That upper limit of the one-sided 95 percent confidence interval on the mean was 6.28 μg/L.

Both measurements indicate the Pu in the tank is well below the level for criticality to be a concern. However, the safety screening DQO requires measurements for two core samples, therefore this criticality safety issue has not been resolved with respect to the DQO. A second core is required to resolve this issue.

4.0 RECOMMENDATIONS

Core sampling of tank 241-T-102 occurred before the implementation of the DQO process for TWRS characterization. Nevertheless the data collected may be evaluated against the requirements of the current safety screening DQO. All analytical results were well within the safety notification limits. The results were from a single-core sample and a grab sample (both from riser 2). The waste that has been sampled and analyzed in accordance with the safety screening DQO has been accepted by the responsible TWRS program. This tank was sufficiently sampled to satisfy the requirements of safety screening (Reynolds et al. 1999). Vapor sampling and analysis is required to address the organic solvent issue. The hazardous vapor issue (toxicity) has been resolved.

Table 4-1 summarizes the TWRS Program review status and acceptance of the sampling and analysis results reported in this TCR. All DQO issues required to be addressed by sampling and analysis are listed in column one of Table 4-1. The second column indicates with a "yes" or a "no" whether the DQO requirements were met by the sampling and analysis activities performed. The third column indicates concurrence and acceptance by the program in TWRS that is responsible for the DQO that the sampling and analysis activities performed adequately meet the needs of the DQO. A "yes" or "no" in column three indicates acceptance or disapproval of the sampling and analysis information presented in the TCR.

Table 4-1. Acceptance of Tank 241-T-102 Sampling and Analysis.

Issue	Sampling and Analysis Performed	PHMC[1] Program Acceptance
Safety screening DQO	Yes	Yes
Hazardous vapor DQO	n/a	Resolved
Organic solvent	No	No

Notes:

n/a = not applicable

[1]PHMC Program Office

Table 4-2 summarizes the status of TWRS Program review and acceptance of the evaluations and other characterization information contained in this report. The evaluations specifically outlined in this report are the evaluation to determine whether the tank is safe, conditionally safe, or unsafe. Column one lists the different evaluations performed in this report. Columns two and three are in the same format as Table 4-1. The manner in which concurrence and

acceptance are summarized is also the same as that in Table 4-1. None of the safety categorization analyses performed, including those for criticality, indicate any safety problems.

Table 4-2. Acceptance of Evaluation of Characterization Data and Information for Tank 241-T-102.

Issue	Evaluation Performed	PHMC Program Acceptance[1]
Safety categorization (tank is safe)	Yes	Yes
Hazardous vapor DQO	n/a	Resolved
Organic solvent	No	No

Notes:

[1]PHMC Program Office

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APPENDIX B

SAMPLING OF TANK 241-T-102

Appendix B provides sampling and analysis information for each known sampling event for tank 241-T-102 and provides an assessment of the push mode and grab sampling results.

- **Section B1**: Tank Sampling Overview
- **Section B2**: Analytical Results
- **Section B3**: Assessment of Characterization Results
- **Section B4**: References for Appendix B

Future sampling of tank 241-T-102 will be appended to the above list.

B1.0 TANK SAMPLING OVERVIEW

This section describes the March 1993 push mode sampling and analysis event for tank 241-T-102. Sampling and analyses were performed in accordance with the requirements of the *Tank Waste Remediation System Tank Characterization Plan* (Bell 1993). Because the sampling event predated DQOs, no DQOs were applicable. For further discussions of the sampling and analysis procedures, refer to the *Tank Characterization Reference Guide* (Delorenzo et al. 1994). A liquid grab sample was taken from this tank in July 1994. The grab sample was taken and analyses were performed in accordance with the requirements of the *Tank 241-T-102 Tank Characterization Plan* (Schreiber 1994). A vapor flammability measurement was taken on May 9, 1996.

Although current DQO's were not in evidence at the time of the push mode sampling event, the sampling and analytical direction would meet the requirements of the current safety DQO. The sampling riser locations were separated radially to the maximum extent possible. Unfortunately, sample recovery for core 56 was insufficient for analysis so only the results from the analysis of core 55 can be used to satisfy the requirements of the safety DQO.

A vertical profile is used to satisfy the safety screening DQO. Safety screening analyses include: total alpha to determine criticality, DSC to ascertain the fuel energy value, and thermogravimetric analysis (TGA) to obtain the total moisture content. The data were reported in Pool (1993). In addition, combustible gas meter readings in the tank headspace are required to measure flammability.

Sampling and analytical requirements from the safety screening DQO is summarized in Table B1-1.

Table B1-1. Integrated Data Quality Objective Requirements for Tank 241-T-102.

Sampling Event	Applicable DQOs	Sampling Requirements	Analytical Requirements
Push Mode Sampling	Safety Screening	Core samples from a minimum of two risers separated radially to the maximum extent possible.	▸Energetics ▸Moisture Content ▸Total Alpha
Combustible Gas Meter Reading	Safety Screening	Measurement in a minimum of one location within tank vapor space.	▸Flammable Gas Concentration
Vapor Sampling	Vapor	Measurement in a minimum of one location within tank headspace.	▸Gases (Ammonia, CO2, CO, NO, NO2, N2O, TOC, tributyl phosphate, n-dodecane, and n-tridecane)

B1.1 DESCRIPTION OF SAMPLING EVENTS

B1.1.1 Push Mode Sampling Event

Two push mode core samples were collected from tank 241-T-102. Core 55 was obtained from riser 2 March 25 and core 56 was obtained from riser 8 on March 26, 1993. The core samples were sent to the Pacific Northwest Laboratory (PNL) on April 1 and May 4, 1993 and extruded on May 14 and April 21, 1993.

Push Mode Core sampling was used because the waste was expected to be relatively soft. The core samples, however, did not recover a full vertical profile of the waste. The waste depth was expected to be 18 cm to 20 (7 to 8 in.) under risers 2 and 8. Core 55 had a core recovery of 65 percent and core 56 had a recovery of approximately 10 percent. Due to the small amount of waste recovered in the core 56 sample, no chemical analyses were performed on it.

B1.1.2 Grab Sampling Event

Three 100 mL grab samples were taken from riser 2 on July 15, 1994. One sample was analyzed and two samples were archived. Analysis was conducted at the 222-S Laboratory.

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